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Using Risk Management Models in

Extension Marketing Programs: A 1986 Crop Year Example

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Abstract

Farmers should include risk and uncertainty in their integrated marketing-management-financial plan, as unmanaged risk often becomes synonymous with financial failure. An extension program uses a simulator and a satellite radio downlink to analyze risk for marketing alternatives and cash flow requirements. Farmers can understand and use probability concepts.

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USING RISK MANAGEMENT MODELS IN
EXTENSION GRAIN MARKETING PROGRAMS: A 1986 CROP YEAR CASE STUDY EXAMPLE

Introduction

Numerous factors have increased the importance for farmers to explicitly include risk and uncertainty in their marketing plans and strategies. While risk has always been a factor in marketing, the need for explicit managerial attention has been accelerated by a combination of events affecting price instability, uncertainty of future market revenues, changes in operating margins and financial stress among many farm operators.

Many of these risk-increasing events are beyond the direct control of producers. Price risk has been increased, for example, by a deterioration in foreign demand for U.S. cereal grain and by a decrease in domestic feed demand. Uncertainty underlies future streams of revenues because of impending changes in U.S. farm policy and federal budget-balancing initiatives. Operating margins are becoming less predictable due to changes in credit market conditions and disemby within OPEC.

In times of predictably rising revenues and widening operating margins, which fairly characterizes much of the latter half of the 1970s, market risk demanded less direct managerial attention than in more recent years. However, as gross farm revenues leveled off or even declined somewhat during the first half of the 1980s at the same time that many farmers were facing rising cash flow needs to service recently acquired debt at escalating interest rates, financial stress became more pervasive in the farm sector. This created a situation for many producers that sharply elevated the costs associated with market risk--for many, unmanaged risk became synonymous with financial failure.

Concurrent with the increased need for improved market risk management skills were two developments that made feasible the implementation of extension education programs tailored to circumstances specific to individual cash grain producers: (1) a working knowledge of viable grain marketing alternatives and (2) widespread availability of microcomputers. Starting at least with such national extension projects as "Marketing Alternatives for Agriculture" in 1976 (Forker and Rhodes) and "Who Will Market Your Products?" in 1978 (Knutson et al.) extension marketing economists have worked to improve farmers' understanding of their marketing alternatives. Over the ensuing years, many thousands of farm operators participated in marketing education programs sponsored by extension, marketing organizations and others. At the same time, the array of marketing alternatives available widened dramatically through developments such as forward contracts, basis contracts, options, minimum price contracts, electronic markets, delayed pricing and the like. Further, through both education and trial and error, most commercial farm operators gained working knowledge of these various marketing alternatives.

Relatively low cost microcomputers have also been rapidly adopted by marketing educators, analysts, and many farm operators. These provided the technology for creating sophisticated analytical models for assessing comparative returns from various marketing strategies with and without participation in government programs, incorporating risk probability functions, and specifying both local market conditions and operating parameters unique to individual farms. The task now became one of developing such analytical capability and extending it to farm operators through educational programs.

Objectives and Procedure of Program

The authors, in conjunction with colleagues, developed a marketing risk management extension education program for commercial grain producers in Ohio. This effort was based upon prior extension programs including outlook and price analysis, marketing alternatives, marketing strategies, and financial management. By 1985, much of the responsibility for conducting basic marketing education in Ohio had been successfully transferred to county agents and district specialists. This allowed state specialists in marketing, financial management and outlook, to concentrate on a single, integrated educational venture that featured all three areas of expertise. Further, building on earlier work done by Anderson and Ikerd, risk was incorporated into the analysis with the ultimate objective of teaching farmers how to identify marketing alternative that maximize their probability of financial survival, given actual market conditions.

Because a strong base of cooperation had been built with field extension personnel, these individuals were involved in the educational process. A marketing risk management computer program was developed that was compatible with microcomputers used by county agents. Visual teaching aids used in conjunction with the computer program facilitated teaching the subject matter over a course of six weekly four-hour class sessions [Baldwin et al.]. Video tapes provided by Farm Credit Services were used to review market alternatives subject matter [Farm Credit Services].

County agents assembled farmer-students at eight locations in the major grain producing regions of the state during January and February, 1986. The computer model and related educational materials were distributed to agents in advance. The authors and other faculty then did the actual teaching via a satellite radio downlink, with WATS phone-back connection for questions, so travel was minimized. Agents handled all materials and coordinated details at each site. The remainder of this paper discusses the risk management model, gives illustrative output, and examines implications for extension programming in grain marketing.

Conceptual Model of Risk

The computer model was introduced with a hand calculated case study designed to illustrate the impact of yield and price variability on short run and long run survival probabilities for three enterprises, corn, wheat and soybeans and for the farm [Baldwin et al., Session III and IV]. Historical yield data to simulate the experience of an individual farm were obtained from variety performance trials, the details of which are reported elsewhere [Lee and Djogo]. The statistical concepts were presented using terminology suggested by Anderson and Ikerd, i.e., the mean +/- one standard deviation were presented as the "expected", "optimistic" and "pessimistic" values. "Risk ratings" for yields, prices and gross incomes per acre were based on the coefficients of variation which were presented as "rules of thumb". For example, a coefficient of variation for crop yields = 0.2 became "...in two years out of three, actual yields will be within 20 percent of the average yield." These rules of thumb were tested against the values actually observed over the period 1972-84.

Based on the simulations, the coefficients of variation for total receipts per acre for corn, soybeans and wheat were estimated to be 0.26, 0.24 and 0.27, respectively. These values were rounded and summarized as "in two years out of three, actual gross income per acre will be within 25 percent of the average."

Variability in prices (futures prices plus basis) is a function of the selection of the marketing alternative and the enterprise by farmers. Forward contracts (FC), government programs (GP) and minimum price fixed basis contracts (MPFB) eliminate futures and basis risks, for example. Upside price variability continues to exist for MPFB, however. Hedges (H), commodity options (CO) and minimum price variable basis contracts (MPVB) are exposed to basis risk but not futures price risk. For CO and MPVB, upside price variability does exist, however. Basis contracts (BC) fixes the basis but futures price risk exists. Delayed price contracts (DP) and future cash sales (CS) are subject to both basis and futures price risks [Baldwin, et al., Session V].

The argument that the futures market can predict prices in future time periods is based on prior research [Just and Rausser]. Probabilities associated with price predictions are from Anderson and Ikerd. Basis probabilities for the respective enterprises for Ohio are derived from an unpublished Masters thesis [Dayton]. The statistical concepts were again presented as expected, optimistic and pessimistic outcomes or the mean +/- one standard deviation. Joint yield, price and basis probabilities determine the variation in net optimistic and pessimistic returns (Total revenue, TR, minus total variable production and marketing cost, TVC) for each enterprise.

Short term and long run survival are based on the joint probabilities which determine the optimistic and pessimistic net returns (TR minus TVC minus Cash Flow Requirements, CF). As cash flow requirements increase both in the short term and long run, the probability for survival diminishes.

The Marketing Risk Management Simulator

The marketing risk management simulator uses Lotus 123 software, and runs on a micro computer which has a MS-DOS operating system and 256 K of RAM. The menu driven simulator is comprised of four integrated parts, three enterprise models (corn, soybeans and wheat) and a farm risk model. Each enterprise is modeled to determine the expected, optimistic and pessimistic net returns for the sale of grain to four elevators in three time periods for ten different marketing alternatives, and $P(TR \geq TVC)$.

The user selects the optimum marketing alternative, elevator and time period for selling grain by examining net expected returns (total per acre revenue minus total variable production and marketing costs).

The farm risk model uses the expected, optimistic and pessimistic output for the optimum marketing alternative for each enterprise as input to determine the short term and long run expected, optimistic and pessimistic net farm returns. For the farm, the $P(TR \geq TVC + CF)$ is determined for each time period.

Input Screens for One Enterprise

The enterprise simulator models the selling of grain by a farmer to four elevators. Data are entered by the county agent or farmer into elevator, futures and producer input screens (Figure 1)., The data entries for the elevator and futures input screens may be accessed by more than one user. For each elevator, FC, MPFB, MPVB, BC, DP, CS and historic basis (HB) data are collected and are entered via the input screen. For the futures market, futures price (FP) data and commodity option (CO) data are entered.

Each farmer enters total planted acres for the enterprise, average variable cost ($/Bu.) and maintenance on set-aside land ($/planted acre) into the variable cost input screen. The simulator automatically transfers TVC data to the producer input screen, and total acres and maintenance on set-aside to the output screens. To complete the producer input screen, the farmer enters storage cost, expected yield, selects one of four elevators and the corresponding transportation cost, selects two futures contracts to identify the time period for selling grain, forecasts harvest or selling price and related basis and enters his name.

Output for Enterprise Models

Four pages of output are generated for the ten marketing alternatives; expected, optimistic and pessimistic net returns are determined for CS, FC, MPFB, MPVB, BC, DP, CP, government program (GP) without repayment of loan and government program with loan repayment or sale at harvest (Figure 1). Using the area under a normal curve as a look up table in the simulator, the $P(TR \geq TVC)$ for each marketing alternative is determined.

Producer Input and Farm Risk Output Screens

To complete the farm firm analysis, the producer must complete two parts of an additional producer cash outlay input screen. One part includes short term cash obligations including family living and capital loan payments. The second includes longer run cash obligations including capital replacement long term debt payments and financial growth objectives (Figure 1). Total expected, optimistic and pessimistic net returns for the short term and long run are determined (TR-(TVC+CF)). The P(TR $\geq$ TVC + CF) is determined for each time period from the area under the normal curve.

Data for a Hypothetical Eastern Cornbelt Farm

The federal corn loan rate and the deficiency payment for 1986 are estimated at $1.84 and $0.68, respectively. The wheat loan rate is estimated to equal $2.30 with a corresponding deficient payment of $1.61 [Henderson]. It is assumed that the hypothetical farm operator uses the model to answer the question, "Should I participate in the feed and food grain programs?"

The impact of a relatively low, average and relatively high short term cash flow requirement on P(TR $\geq$ TVC + CF) is also analyzed for this hypothetical farm (Table 1). The farm consists of 750 acres of corn, 750 acres of soybeans and 100 acres of wheat. All costs, prices, etc. associated with this farm are reported in Table 1.

Partial Solution for the Hypothetical Farm: Non-Participation in Government Grain Programs

The optimum marketing alternative for corn is the March 1987 forward contract (Table 1). The P(TR $\geq$ TVC) = 96 percent. Net returns per acre will range between $40 and $155 per acre 66 percent of the time. For soybeans, the optimum marketing alternative is the January 1987 basis contract. For wheat, the optimum marketing alternative is a December 1986 hedge (Table 1).

The probability that the farm firm will break even or have positive net returns in the short term varies with the cash flow requirement (Table 1). The expected and optimistic net returns are positive only for the farm firm with a relatively low cash flow requirement. Survival in the short term and growth in the long run is probable for a farm which has a low cash flow requirement. Survival is an unlikely event for a farm with either average or relatively high cash flow requirements.

Partial Solution for Hypothetical Farm: Participation in Government Programs

The farmer participates in the corn and wheat programs by repaying the loan and selling corn via a March 1987 forward contract and wheat via a December 1986 hedge. Deficiency payments increase prices received, net returns and the P(TR $\geq$ TVC) relative to the findings for the non-participants. Since the expected basis contract price is greater than the soybean loan rate, the farmer elects to not participate in the soybean program. Therefore, soybean prices and net returns equal those received by non-participants (Table 1).

Although set-aside requirements must be met to participate in the programs, P(TR $\geq$ TVC + CF) and the expected net returns for the farm increase relative to those for the non-government participants (Table 1). It is probable that a farm with relatively low cash flow requirements will survive and prosper in both the short term and long run. A farm with average cash flow requirements has a 46 percent chance for short term survival and a 42 percent chance for long term growth. It is unlikely that the farm with a relatively high cash flow requirement will survive even in the short term.

Implications

Farmers can understand and use probability and related statistical concepts. Members of the audience indicated that the quantity of material presented in each session and the rigor of the discussions could be increased. The rigor of the questions provide additional evidence that members of the audience understand these concepts.

Presenting these concepts via a satellite radio downlink proved to be successful. Members of the audience were able to follow the discussion via the overheads; the video tapes adequately defined and reviewed the pros and cons of the different marketing alternatives; and field personnel responded to most questions, reviewed the homework and used the simulator as a teaching tool.

Field personnel and individual farmers who have micros are cointinuing to use the simulator to make integrated management-marketing-financial decisions. Since loan rates are lower than market clearing price for many of the marketing alternatives, the optimum marketing plan requires participation in the government corn and wheat programs with sale at harvest or sale during the storage period with repayment of the loan. Based on existing market and outlook information, the simulator is particularly useful for selecting the optimum combination of marketing alternatives, elevators, time periods to sell grain and loan repayment schedules. The model also provides useful information for making management and financial decisions. Improving management efficiency and/or decreasing cash flow requirements or interest rates increases the expected returns and the probability for survival. "What if" questions can be answered based on current marketing, production and financial information.

Table 1: Selected Input and Output Data for a Hypothetical Cash Grain Farm, A Case Study for the Eastern Cornbelt

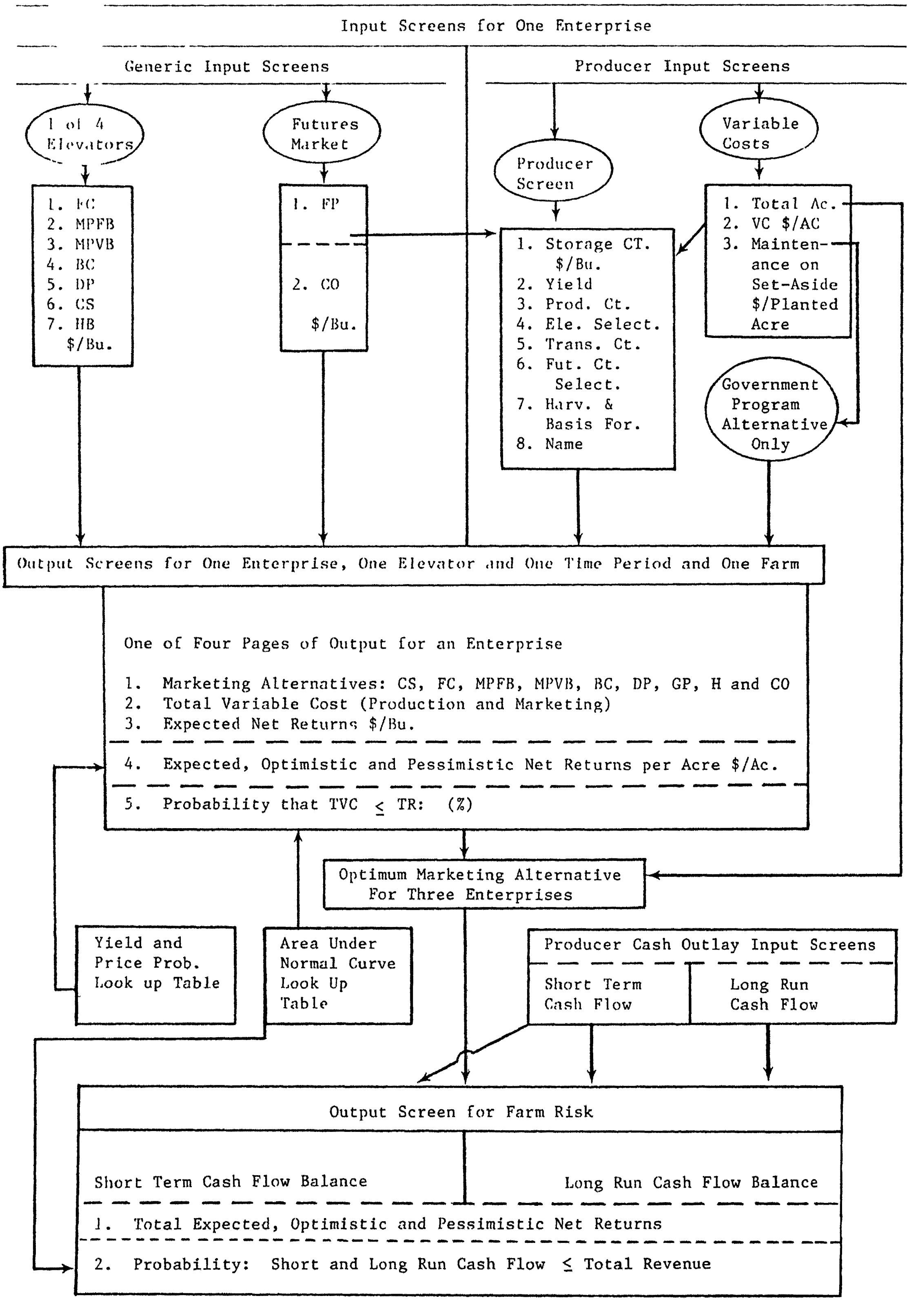
Selected Input and Output Data for Three Enterprises

	CORN				SOYBEANS				WHEAT			
	INPUT		OUTPUT		INPUT		OUTPUT		INPUT		OUTPUT	
Time Periods	Harv.	Mar. 87			Harv.	Mar. 87			Harv.	Dec. 86		
Government Program Decision			Non Partic.	Partic.			Non Partic.	Partic.			Non Partic.	Partic.
TVC $/Bu.												
Non Gov't Partic.	1.33	1.33			2.70	2.70			1.82	1.82		
Gov't Participation	1.38	1.38			2.70	2.70			1.98	1.98		
Prices $/Bu.												
Forecast Harvest	2.15				5.00				2.44			
Foreward Contract		2.40				5.35				2.64		
Futures		2.34				5.50				2.84		
Basis Contract Bases		-0.25				-0.22				-0.20		
Delayed Price Charges	0.03	0.05			0.10	0.16			0.10	0.25		
Historic Basis	-0.30	-0.16			-0.40	-0.10			-0.30	-0.05		
Mktg. Alternative			FC	FC			BC	BC			Hedge	Hedge
Time Period			Mar. 87	Mar. 87			Jan. 87	Jan. 87			Dec. 86	Dec. 86
Price$/Bu			2.4	3.05			5.2	5.2			2.79	4.4
Net Ret. $/Bu.			0.81	1.48			2.32	3.32			0.53	2.05
Net Ret. $/Ac.												
Optimistic			155	250			136	136			50	133
Expected			97	177			93	93			24	92
Pessimistic			40	104			50	50			- 2	51
Prob. TR$\geq$TVC (%)			96	99			98	98			82	99

Selected Output Data for the Hypothetical Farm Firm

	SHORT TERM						LONG TERM					
Cash Flow Requirements	($64,000 Low)		($208,000 Medium)		($344,000 High)		($74,000 Low)		($218,000 Medium)		($354,000 High)	
Government Program Decision	Partic.	Non Partic.	Partic.	Non Partic.	Partic.	Non Partic.	Partic.	Non Partic.	Partic.	Non Partic.	Partic.	Non Partic.
Net Returns ($000)												
Optimistic	219	114	75	- 30	- 61	- 166	209	104	65	- 40	- 71	- 176
Expected	133	50	- 10	- 94	- 147	- 230	123	40	- 20	- 104	- 156	- 240
Pessimistic	48	- 14	- 96	- 158	- 232	- 294	38	- 24	- 106	- 168	- 242	- 340
Prob. TR$\geq$TVC+CF (%)	95	79	46	7	4	> 1	92	73	42	5	4	> 1

Figure 1: Flow Diagram of Risk Management Marketing Simulator for One of Three Enterprises (Corn, Wheat or Soybeans), One Elevator and One Time Period, and For Farm Risk



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